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IS 8871 (2004): Metallic Powders - Determination of tap density [MTD 25: Powder Metallurgical Materials and Products]



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भारतीय मानक
धात्विक पाउडर — टैप धनत्व ज्ञात करना
(दूसरा पुनरीक्षण)

Indian Standard
METALLIC POWDERS —
DETERMINATION OF TAP DENSITY
(*Second Revision*)

ICS 77.160

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NATIONAL FOREWORD

This Indian Standard (Second Revision) which is identical with ISO 3953 : 1993 'Metallic powders — Determination of tap density' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendations of the Powder Metallurgical Materials and Products Sectional Committee and approval of the Metallurgical Engineering Division Council.

IS 8871 was first published in 1977 and subsequently revised in 1991 harmonizing with International Standard and adopting ISO 3953 : 1985.

Since ISO 3953 has been revised in 1993, therefore, need was felt to revise IS 8871 : 1991 also. In this revision Table 2 has been modified.

In this adopted standard, some terminology and conventions are, however, not identical to those used in Indian Standards. Attention is especially drawn to the following:

- a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.
- b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

METALLIC POWDERS — DETERMINATION OF TAP DENSITY (*Second Revision*)

1 Scope

This International Standard specifies a method for the determination of tap density, i.e. the density of a powder that has been tapped in a container under specified conditions.

2 Principle

A specified amount of powder in a container is tapped by means of a tapping apparatus until no further decrease in the volume of the powder takes place. The mass of the powder divided by its volume after the test gives its tap density.

By agreement, the tapping may be carried out by hand.

3 Symbols

Table 1

Symbol	Meaning	Unit
ρ_t	Tap density	g/cm^3
m	Mass of the powder	g
V	Volume of the tapped powder	cm^3

4 Apparatus

4.1 Balance, of appropriate capacity and accuracy to satisfy the requirements shown in table 2.

4.2 Graduated glass cylinder, calibrated to contain 100 cm^3 , the height of the graduated portion being approximately 175 mm. The graduations shall be at 1 cm^3 intervals, thus allowing a measuring accuracy of $\pm 0,5 \text{ cm}^3$.

Alternatively:

Graduated glass cylinder, calibrated to contain 25 cm^3 , the height of the graduated portion being ap-

proximately 135 mm. The graduations shall be at $0,2 \text{ cm}^3$ intervals.

A 25 cm^3 cylinder shall be used for powders of apparent density higher than 4 g/cm^3 , in particular for refractory metal powders, but may also be used for powder of lower apparent density.

4.3 Tapping apparatus, which permits the tapping of the graduated cylinder against a firm base. The tapping shall be such that a densification of the powder can take place without any loosening of its surface layers. The stroke shall be 3 mm and the tapping frequency shall be between 100 and 300 taps per minute. An example of a tapping apparatus is shown in figure 1.

Alternatively, by agreement only:

Hard rubber slab (measuring approximately $100 \text{ mm} \times 100 \text{ mm} \times 5 \text{ mm}$).

5 Sampling

5.1 For the quantities of powder required for each test, see table 2.

Table 2

Apparent density g/cm^3	Cylinder capacity cm^3	Mass of test portion g
≥ 1	100	$100 \pm 0,5$
< 1	100	$50 \pm 0,2$
> 7	25	$100 \pm 0,5$
> 2 to 7	25	$50 \pm 0,2$
0,8 to 2	25	$20 \pm 0,1$
$< 0,8$	25	$10 \pm 0,1$

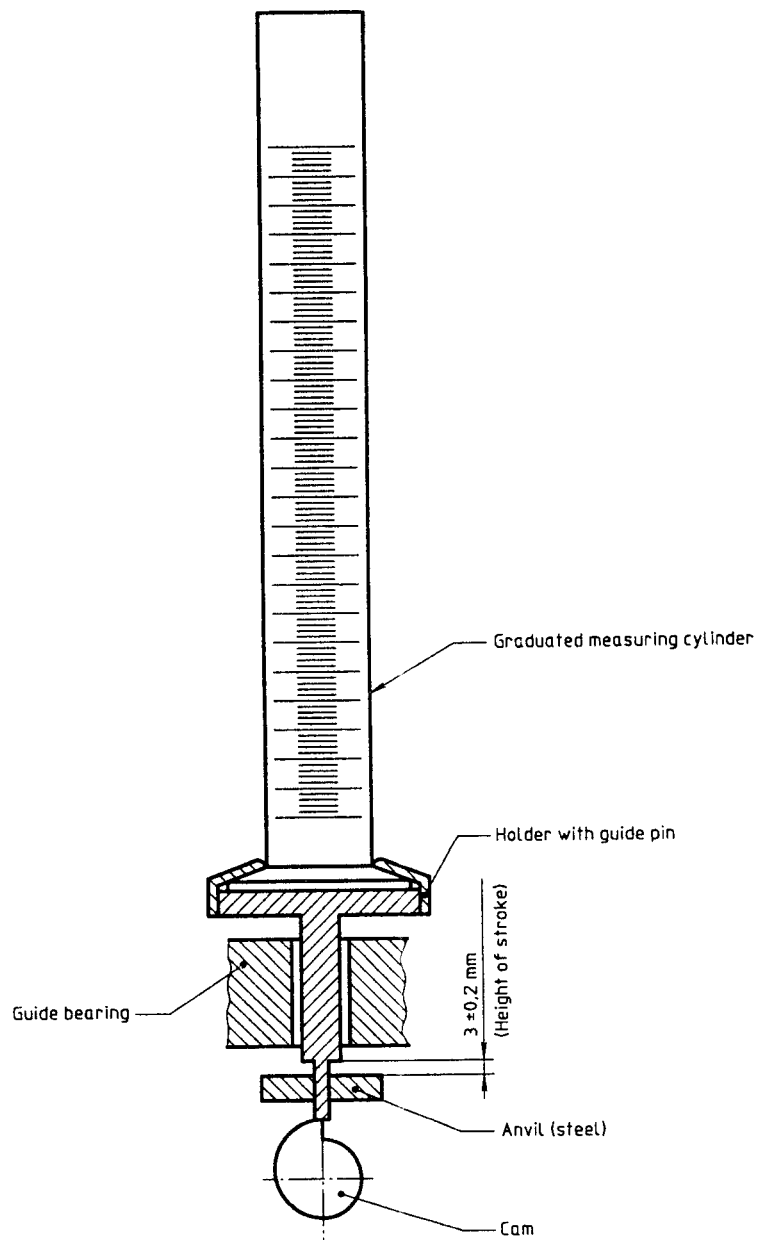


Figure 1 — Example of tapping apparatus

5.2 In general, the powder should be tested in the as-received condition. In certain instances the powder may be dried. However, if the powder is susceptible to oxidation, the drying shall take place in vacuum or in inert gas. If the powder contains volatile substances, it shall not be dried.

5.3 The test shall be carried out on three test portions.

6 Procedure

6.1 Clean the inside wall of the graduated cylinder (4.2) with a suitable clean brush or, if necessary, by rinsing with a solvent, such as acetone. If a solvent is used, thoroughly dry the cylinder before re-use.

6.2 Weigh, to the nearest 0,1 g, the mass of the test portion as indicated in table 2, using the balance (4.1).

6.3 Pour the test portion into the graduated cylinder. Take care that a level surface of the powder is formed. Place the cylinder in the tapping apparatus (4.3). Tap the cylinder until no further decrease in the volume of the powder takes place (see note 1).

By agreement, the tapping may be carried out as follows.

Tap the cylinder by hand against a hard rubber slab (4.3) until no further decrease in the volume takes place. Towards the end of the procedure, tap gently in order to avoid loosening the surface layers of the powder (see note 2).

NOTES

1 In practice, the minimum number of taps N such that no further change in volume takes place would be determined. For all further tests on the same type of powder, the cylinder would be subjected to $2N$ taps, except where general experience and acceptance had established a specific number of taps (no less than N taps) as being satisfactory. For fine refractory metal powders, 3 000 taps has been found to be satisfactory for all sizes.

2 In general, the mechanical and manual methods will give comparable results. However, for powders of very low apparent density, or for very fine powders, the results obtained by the two methods may be significantly different.

6.4 If the tapped surface is level, read the volume directly. If the tapped surface is not level, determine the tap volume by calculating the mean value between the highest and the lowest reading of the tapped surface. Read the final volume to the nearest 0,5 cm³ when using a 100 cm³ cylinder and to the nearest 0,2 cm³ when using a 25 cm³ cylinder.

7 Expression of results

The tap density is given by the formula

$$\rho_t = \frac{m}{V}$$

where ρ_t , m and V are as defined in table 1.

Report the arithmetical mean of the three determinations rounded to the nearest 0,1 g/cm³ for values up to and including 4 g/cm³ and to the nearest 0,2 g/cm³ for values greater than 4 g/cm³.

8 Test report

The test report shall include the following information:

- a) a reference to this International Standard;
- b) all details necessary for identification of the test sample;
- c) the drying procedure, if the powder has been dried;
- d) the cylinder capacity, mass of the test portion and method used;
- e) the result obtained;
- f) all operations not specified in this International Standard or regarded as optional;
- g) details of any occurrence which may have affected the result.

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